SEEDS
Number 42
The OARDC Research Enhancement Competitive Grants Program
Ohio Agricultural Research and Development Center
College of Food, Agricultural, and Environmental Sciences

The Waterman Ecological Treatment System (WETS)

Jay F. Martin, Food, Agricultural, and Biological Engineering
Armando Hoet, Veterinary Preventive Medicine
Clifton M. Monahan, Veterinary Preventive Medicine
Martin F. Quigley, Horticulture and Crop Science

■ Solar energy and naturally occurring living organisms address wastewater problems from the Waterman animal production facility.

Disposal and treatment of wastewater is a challenge facing all animal production facilities. The many negative factors resulting from animal wastes include decreased efficiency, decreased environmental quality both on-site and downstream, increased costs, and negative social perceptions.

As the rural-urban interface becomes more complex, especially in Ohio, comprehensive treatment of animal waste, rather than dilution or disposal, must become both energy efficient and ecosystem appropriate. Because of the negative impact of agricultural waste upon the quality of the nation's waters, the U.S. Environmental Protection Agency has recently proposed new, stricter regulations for wastewater from these facilities (USEPA 2001). The overall goal of this SEEDS-supported project was to develop and test a prototype ecological treatment system to treat and utilize dairy wastewater.

This interdisciplinary team included an ecological engineer, an expert in aquatic and riparian vegetation, and an expert in animal pathogens. The team came together to design and build a treatment system specifically to address the wastewater problems of an animal production facility by exploiting naturally occurring living organisms.

The Waterman Ecological Treatment System (WETS) created at the Ohio State University's Waterman Farm on the Columbus campus is based on similar ecological systems used to purify municipal and industrial wastewaters and a successful lab-scale treatment system.

For WETS, aerobic and anaerobic reactors, planted clarifiers, and planted wetlands were designed and enclosed in a polyhouse or hoop house at the dairy facility on the Waterman Farm. A constant stream of dairy wastewater was added to the system with a total of 1,310 liters of water being treated daily.

Using this system it was found that the WETS successfully treated dairy wastewater, which can then either be reused or discharged safely. Total solids and carbon were reduced significantly as were nitrogen and phosphorous. Reducing carbon is important since carbon released into streams causes oxygen levels to be reduced, resulting in fish kills and negative impacts on other wildlife. WETS consistently reduced total coliform and *E. coli* concentrations by at least 96% from influent to effluent and completely eliminated *Salmonella* from the effluent. Furthermore, a major advantage of this type of system is that it uses solar energy to drive the treatment processes, rather than relying on fuel.

The study also explored the potential for creating value-added products, such as ornamental plants and vegetables grown through hydroponics. The potential for this is extremely high because the wastewater moving through the system is nutrient dense. However, additional experiments need to be conducted to determine feasibility, and these experments are being planned for the future.

The team has continued to test the ability of the system to treat different amounts of liquid manure, and those tests are currently being analyzed. Results of this additional experiment will help determine the limitations of the system and aid in the design of an actual on-farm system.

This SEEDS-supported project successfully leveraged funds in the amount of $119,000 from the U.S. Department of Agriculture. The next step to building on the successful results of this project will be to better define the ability of the system to reduce pathogen concentrations and test the system scaled to a larger facility.

THE OHIO STATE UNIVERSITY OARDC

THE OHIO STATE UNIVERSITY COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

This research is supported in part by state of Ohio funds allocated to the Ohio Agricultural Research and Development Center of The Ohio State University.

June 2007 FS42-07